The Hypothalamus and Types of Aggressive Behavior in the Rat

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colliculus), and large moving visual stimuli (perhaps via the pretectum). Defense may also be activated via forebrain circuits that traverse the perifornical hypothalamus, but the forebrain is not necessary for defense behavior. The motor patterning mechanism activated by defense in muroid rodents includes freezing, flight, defensive upright posture, threat patterns, and – characteristically – a lunge-and-bite attack directed at the face of the opponent. Defense is rarely observed in laboratory animals, but is commonly seen in wild animals, during maternal nest defense, and in laboratory animals following olfactory or forebrain lesions.

The motivational mechanism of submission is apparently located in the midbrain central gray. It may be activated by the same motivating stimuli as those of defense. Its motor patterns in muroid rodents include freezing, flight, defensive upright posture, full submissive posture, threat patterns, ultrasound, but *not* lunge-and-bite attack. Submission is often observed in laboratory animals that are attacked.

The forebrain, it is suggested, switches an animal from defense to submission in the presence of familiar consociate (conspecific, laboratory technician, etc.) stimuli. More specifically, it is suggested that the neural circuitry of the ventromedial hypothalamus is a logical "and-gate" switch that is activated by the confluence of amygdala and septal inputs (representing familiar consociate stimuli) and midbrain central gray input (representing defense inputs) and that it inhibits the defense motivational mechanism and facilitates the submission motivational mechanism.

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Aggressive behavior of male rats can be observed in a variety of situations and seems to serve a variety of goals. The experiments presented indicate that different types of aggressive behavior are not only elicited by different external stimuli, but are also based on different internal mechanisms.

Electrical stimulation of the lateral hypothalamus (LH) elicits either of two types of aggressive behavior in the presence of a male conspecific. One type closely resembles behavior performed in a territorial situation, characterized by fighting and several threatening postures and a strong orientation of the behavior towards the opponent. In the second type these threatening postures are rare; the stimulated animal just wanders about, fighting only when it happens to meet the opponent. This behavior may be described as reactive fighting. The data suggest a slightly different electrode localization for these two types of aggressive behavior.

Lesions in the ventromedial hypothalamus (VMH) can facilitate either of these types of intraspecific aggressive behavior, depending on the exact location of the lesion. Posterior VMH lesions facilitate territorial aggressive behavior, whereas anterior VMH lesions increase the tendency to perform reactive fighting.

Both the stimulation and the lesion procedures described here appear to influence the occurrence of aggressive behavior specifically. It is concluded that at the level of the VMH and of the LH, neural mechanisms seem to exist that underlie either defensive or offensive aspects of aggressive behavior.

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ACTH and Vasopressin Treatments Immediately After a Defeat Increase Future Submissiveness

Earlier studies have suggested that the hormonal responses to defeat can serve behaviorally adaptive functions by feeding back and modifying either ongoing or future agonistic responses. These earlier studies have used the technique of preventing hormonal responses and observing behavioral changes subsequent to defeat. We report here the results of two studies using the opposite approach: These studies examined the effects on future submissiveness of augmenting the usual hormonal responses to defeat by exogeneous hormone treatments.

Mice were subjected to an initial defeat by an unfamiliar conspecific and treated immediately with either ACTH, lysine vasopressin, or a saline placebo. They then were tested for submissiveness at either 24 hours, 48 hours, or seven days after the initial agonistic experience and hormone treatment. Postdefeat treatment with either ACTH or vasopressin increased future submissiveness relative to controls, although the time courses of the effects of the two hormones were different. Postdefeat treatment with ACTH increased submissiveness when measured at 24 and 48 hours after the initial experience but not when measured at seven days. On the other hand, postdefeat treatment with vasopressin still affected submissiveness when measured at seven days. These results are interpreted as supporting the hypothesis that the acute hormonal responses to defeat can feed back and modify future agonistic, in this case submissive, responses.

SYMPOSIUM: FACES OF ANTIVIOLENCE

Chair: John Paddock, Institute of Oaxaca, Oaxaca, Mexico

Several villages and towns in one arm of the Valley of Oaxaca, in southern Mexico, have what may be called "unnaturally" low homicide rates; that is, their rates are only a fraction of those prevailing in neighboring and outwardly similar communities, in the valley as a whole, and in the state. These low homicide rates appear to reflect a general attitude of repudiation of interpersonal violence, and the phenomenon is termed antiviolence.